COVENANT UNIVERSITY
NIGERIA

TUTORIAL KIT
OMEGA SEMESTER

PROGRAMME: BIOCHEMISTRY

COURSE: BCH 121

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BCH 121: Introductory Biochemistry

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1) Outline the common techniques for separating and Purifying Biomolecules

- Salt fractionation (eg, precipitation of proteins with ammonium sulfate)
- Chromatography: Paper; ion exchange; affinity; thin-layer; gas-liquid; high-pressure liquid; gel filtration
- Electrophoresis: Paper; high-voltage; agarose; cellulose acetate; starch gel; polyacrylamide gel; SDS-polyacrylamide gel
- Ultracentrifugation

2) List the Methods for Determining Biomolecular Structures

- Elemental analysis
- UV, visible, infrared, and NMR spectroscopy
- Use of acid or alkaline hydrolysis to degrade the biomolecule under study into its basic constituents
- Use of a battery of enzymes of known specificity to degrade the biomolecule under study (eg, proteases, nucleases, glycosidases)
- Mass spectrometry
- Specific sequencing methods (eg, for proteins and nucleic acids)
- X-ray crystallography

3) Mention the preparative techniques for Studying Biochemical Processes

- Whole animal (includes transgenic animals and animals with gene knockouts)
- Isolated perfused organ
- Tissue slice
- Whole cells
- Homogenate
- Isolated cell organelles
- Subfractionation of organelles
- Purified metabolites and enzymes
- Isolated genes (including polymerase chain reaction and site-directed mutagenesis)

4) Discuss exhaustively on the career prospects of biochemists

Ans XXXXXXXXX

5) In a tabular form, differentiate between Prokaryotic and Eukaryotic cell

Prokaryotic cell	Eukaryotic cell
Always unicellular	Often muticelluar
No nucleus	Have nucleus

DNA is circular	DNA is linear
Cell division is by binary	Cell division is by mitosis or meiosis
Reproduction is asexual	Reproduction is Sexual and asexual
Ribosomes are smaller	Ribosomes are larger

6) **Describe the biochemical structure and functions of the following organelles:**

i) Nucleus ii) Ribosome

i) NUCLEUS: The cell nucleus is the most conspicuous organelle found in a eukaryotic cell. It houses the cell's chromosomes, and is the place where almost all DNA replication and RNA synthesis (transcription) occur. The nucleus is spherical and separated from the cytoplasm by a double membrane called the nuclear envelope. The nuclear envelope isolates and protects a cell's DNA from various molecules that could accidentally damage its structure or interfere with its processing. This is the cell's information center. Only Eukaryotic cells contain a nucleus within which is found DNA. The nucleus regulates all cell activity. It does this by controlling the enzymes present.**(2mks)**

ii) **RIBOSOME:** Ribosomes are tiny particles, about 200 A. It is composed of both proteins and RNA. They are produced in the nucleolus, which is a prominent globular structure in the nucleus. Ribosomes from different types of cells have the same basic structure but vary in size. They are composed of two subunits: Large (50S) and Small subunit (30S). Main function is in the synthesis of protein. **(2mks)**

7) List five functions of protein

1. Enzyme catalysis. Enzymes are globular proteins, with a three dimensional

shape that fits snugly around the chemicals they work on, facilitating chemical reactions by stressing particular chemical bonds.

2. Defense. Other globular proteins use their shapes to “recognize” foreign microbes and cancer cells. These cell surface receptors form the core of the body’s hormone and immune systems.

3. Transport. A variety of globular proteins transport specific small molecules and ions. The transport protein hemoglobin, for example, transports oxygen in

the blood, and myoglobin, a similar protein, transports oxygen in muscle. Iron is transported in blood by the protein transferrin.

4. Support. Fibrous, or threadlike, proteins play structural roles; these structural proteins include keratin in hair, fibrin in blood clots, and collagen, which forms the matrix of skin, ligaments, tendons, and bones and is the most abundant protein in a vertebrate body.

5. Motion. Muscles contract through the sliding motion of two kinds of protein filament: actin and myosin.

Contractile proteins also play key roles in the cell's cytoskeleton and in moving materials within cells.

6. Regulation. Small proteins called hormones serve as intercellular messengers in animals. Proteins also play many regulatory roles within the cell, turning on and shutting off genes during development, for example. In addition, proteins also receive information, acting as cell surface receptors.

8) Differentiate between Pyrimidines and Purines

Pyrimidines are nitrogenous bases having a single six-membered ring

Example: Cytosine, Thymine, Uracil

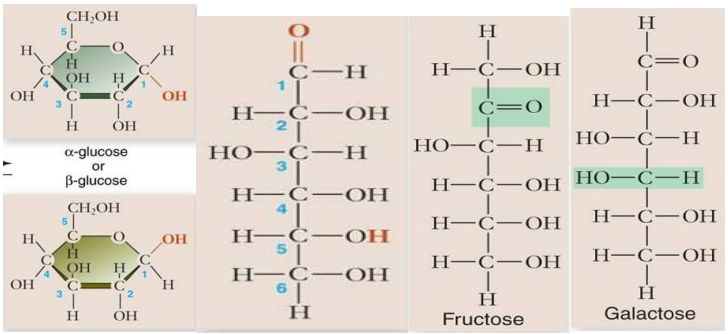
Purines are nitrogenous bases having a six-membered ring fused to a five-membered ring

Example: Adenine, Guanine

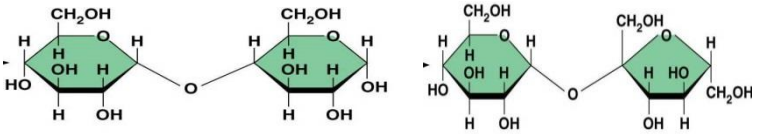
9) What are Structural Isomers?

Structural Isomers: Compounds with the same molecular formular but different structural formula i.e. they are bounded in different orders. Example: Fructose is a structural isomer of glucose

10) Draw the structures of a named monosaccharide and a disaccharide



(monosaccharides)



Maltose **Sucrose**

11) Briefly explain the levels of Protein structure

- Primary structure- refers to the linear sequence of amino acids in the polypeptide chain. It is held together by covalent bonds.
- Secondary structure- refers to the coiling or bending of the polypeptide into sheets, it is mainly formed by hydrogen bonds. There are two types of stable secondary structure: Alpha helices and Beta sheets.
- Tertiary structure- overll 3-dimensional arrangement of all atoms in a protein. Held together by disulphide bonds, ionic bonds. E.g Globular and Fibrous protein
- Quaternary structure- results from interactions between the subunits of complex proteins; when a protein consists of multiple polypeptide chains

12) What is cell?

- The cell is the structural and functional unit of all known living organisms.
- It is the smallest unit of an organism that is classified as living, and is often called the building blocks of life.
- Some organisms, such as most bacteria, are unicellular (consist of a single cell).

13) Estimate the number of cells in human

100 trillion or 10^{14} cells

14) The cell theory, first developed by …… and in the year …….

Ans: Matthias Jakob Schleiden and Theodor Schwann: and 1839

15) Define enzymes?

Ans: They are biological catalyst in living organisms.

16) A systematic classification of enzymes was adopted on the recommendation of which organisation?

Ans: International Enzyme Commission (IEC).

17) The new system of classification divide enzymes into …… major classes and set of …… according to the type of reaction catalises.

Ans: six and sub-classes

18) What are the composition that constitutes the new systemic name of each enzymes?

- A **recommended name** that is usually **very short**.
- A **systematic name** that identifies the reaction it catalyses.
- A **classification number** that is needed where it is accurate and unambigous.

19) Suggest the carbon based chemicals building block of life.

- Carbohydrates: CHO

- ❑ Lipids: CHO, water insoluble
- ❑ Proteins: CHONS, structure/function in cells
- ❑ Nucleic acids: CHONP, hereditary (genetic) information **.**

20) Suggest the two mechanisms for t**he theory of biological evolution as proposed by Jean Baptiste de Lamarck.**

1. The principle of use and disuse: body parts grows in proportion to their usage. The once not used get weaker and shrinks.
2. The inheritance of acquired characteristics: changes occur during lifetime are inherited by its offspring.